Mullard

TECHNICAL DATA

EF86/6267

VOLTAGE AMPLIFYING PENTODE

Low noise pentode intended for use as R.C. coupled A.F. voltage amplifier, particularly in the early stages of high-gain audio amplifiers, microphone pre-amplifiers and magnetic tape recorders.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	200	mA

MOUNTING POSITION

Any

CAPACITANCES (Measured without external screen)

C_{out}	5.5	pF
C_{in}	4.0	pF
C_{a-g1}	0.025	pF
C_{g1-h}	0.0025	pF

CHARACTERISTICS

V_a	250	V
V_{g3}	0	V
V_{g2}	140	V
I_a	3.0	mA
I_{g2}	0.6	mA
V_{g1}	−2.0	V
g_m	1.8	mA/V
r_a	2.5	M Ω
μ_{g1-g2}	38	

OPERATING CONDITIONS AS R.C. COUPLED A.F. AMPLIFIER

Pentode connection

V_b (V)	R_a (k Ω)	I_k (mA)	R_{g2} (M Ω)	R_k (k Ω)	$\frac{V_{out}}{V_{in}}$	V_{out} ($V_{r.m.s.}$)	D_{tot} (%)	R_{g1}* (k Ω)
400	100	3.3	0.39	1.0	124	87	5.0	330
350	100	2.85	0.39	1.0	120	75	5.0	330
300	100	2.45	0.39	1.0	116	64	5.0	330
250	100	2.05	0.39	1.0	112	50	5.0	330
200	100	1.65	0.39	1.0	106	40	5.0	330
150	100	1.0	0.47	1.5	95	22	5.0	330
400	220	1.55	1.0	2.2	200	73	5.0	680
350	220	1.4	1.0	2.2	196	63	5.0	680
300	220	1.1	1.0	2.2	188	54	5.0	680
250	220	0.9	1.0	2.2	180	46	5.0	680
200	220	0.75	1.0	2.2	170	36	5.0	680
150	220	0.55	1.0	2.7	150	24.5	5.0	680

*Grid resistor of following valve.

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Triode connection (g_2 to a; g_3 to k)

V_h (V)	R_a (k Ω)	I_a (mA)	R_k (k Ω)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	D_{tot}* (%)	R_{g1}† (k Ω)
400	47	3.7	1.2	24.5	64	4.5	150
350	47	3.2	1.2	24.5	53	4.0	150
300	47	2.7	1.2	24	43	3.8	150
250	47	2.3	1.2	23.5	32	3.5	150
200	47	1.85	1.2	23.5	22	3.1	150
400	100	2.0	2.2	28.5	73	4.0	330
350	100	1.7	2.2	28.5	62	4.0	330
300	100	1.5	2.2	28.5	50	3.8	330
250	100	1.25	2.2	28	39	3.7	330
200	100	1.0	2.2	27.5	27.5	3.3	330
400	220	1.05	3.9	32	74	3.8	680
350	220	0.9	3.9	31.5	62	3.7	680
300	220	0.8	3.9	31	51	3.7	680
250	220	0.65	3.9	30.5	39	3.5	680
200	220	0.5	3.9	30.5	28	3.1	680

*Output voltage and distortion at the start of positive grid current. At lower output voltages the distortion is approximately proportional to the voltage.

†Grid resistor of the following valve.

LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	200	V
p_{g2} max.	0.2	W
I_k max.	6.0	mA
V_{g1} max. ($I_{g1} = -0.3$ μA)	−1.3	V
R_{g1-k} max. ($p_a > 0.2$ W)	3.0	MΩ
R_{g1-k} max. ($p_a < 0.2$ W)	10	MΩ
V_{h-k} max. (cathode positive)	150	V
V_{h-k} max. (cathode negative)	100	V
*R_{h-k} max.	20	kΩ

*When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 120 k Ω.

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OPERATING NOTES

1. *Hum.*

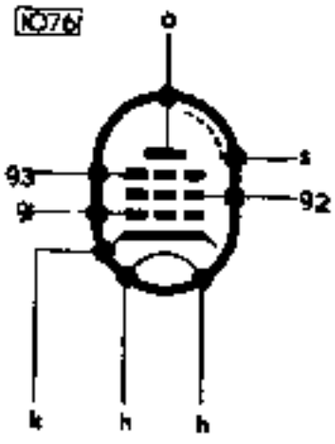
When used as a normal voltage amplifier with a line voltage of 250 V, an anode load of 100 k Ω and a grid resistor of 470 k Ω the maximum hum level of the valve alone is 5 μV, the average value being about 3 μV when operated with one side of the heater earthed. This can be further reduced by centre-tapping the heater to earth. Under these conditions the maximum hum level is 1.5 μV. The low level of hum attained with this valve can be completely masked by that due to an unsuitable valve-holder, in which excessive leakage and capacitive coupling between pins will introduce considerable hum.

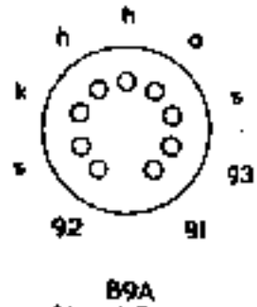
2. *Noise.*

The low-frequency noise generated by a valve is most conveniently specified as an equivalent voltage on the control grid for a specific bandwidth. For the EF86 under normal conditions, i.e. line voltage of 250 V and an anode load of 100 k Ω, the equivalent noise voltage is approximately 2μV for the frequency range 25-10,000 c/s.

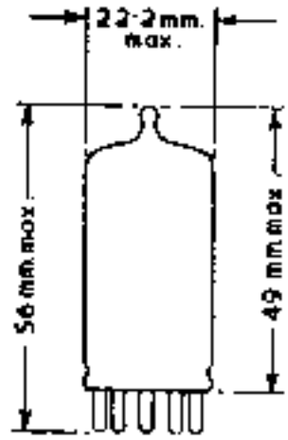
3. *Microphony*

Care in the design of the valve to ensure that the electrode structure and its mounting are as rigid as possible has reduced the microphony of the EF86 to a very low level. There are no appreciable internal resonances at frequencies below 1,000 c/s. At higher frequencies the effect of vibration is usually negligible on account of the damping provided by the chassis and the valve-holder. In high-gain applications such as tape recording care should be taken in siting the valve, particularly when a loudspeaker is present in the same cabinet or when a motor is mounted on the same chassis. In such cases a flexible mounting for the valve-holder or a separate weighted sub-chassis is advisable.





B9A
Noval Base



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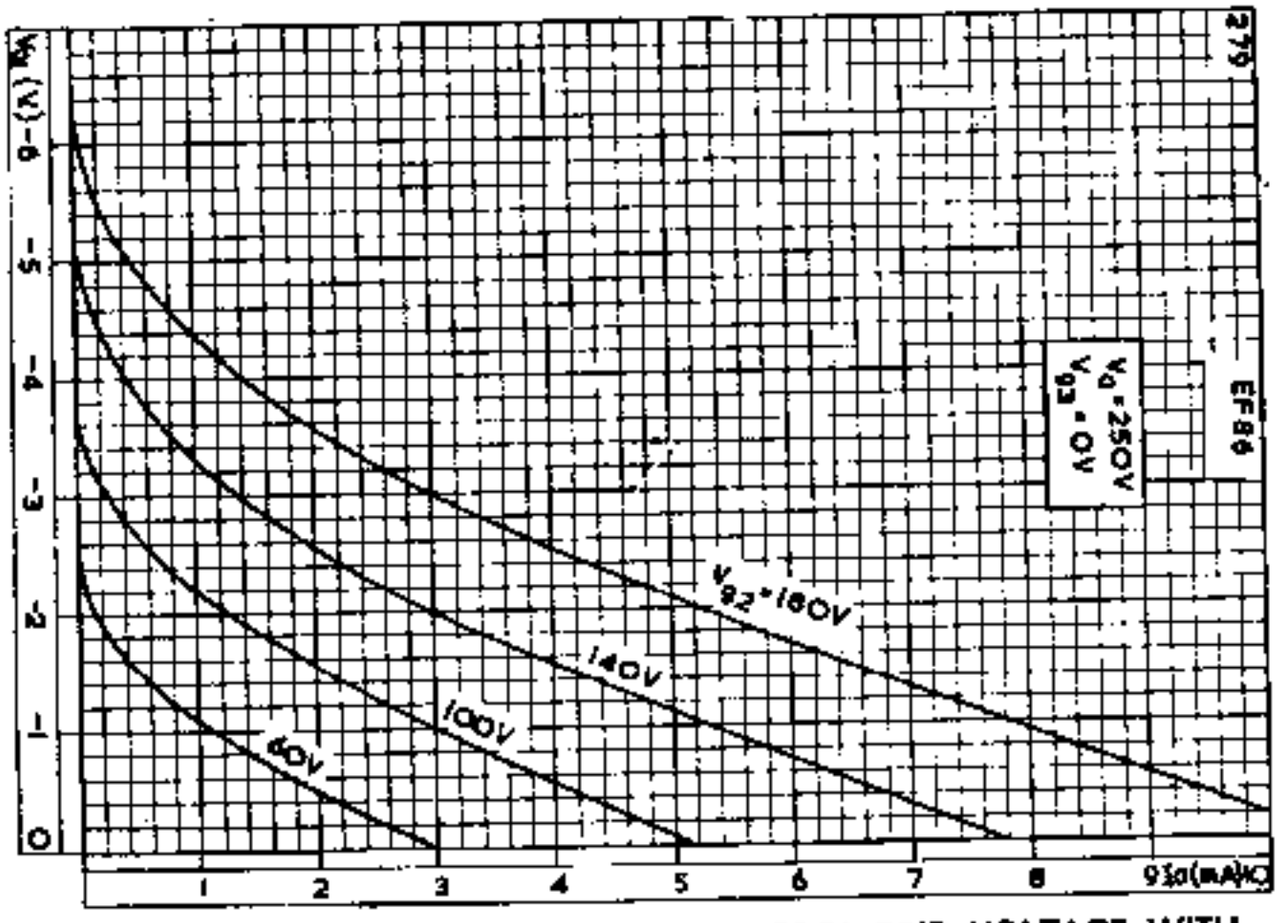
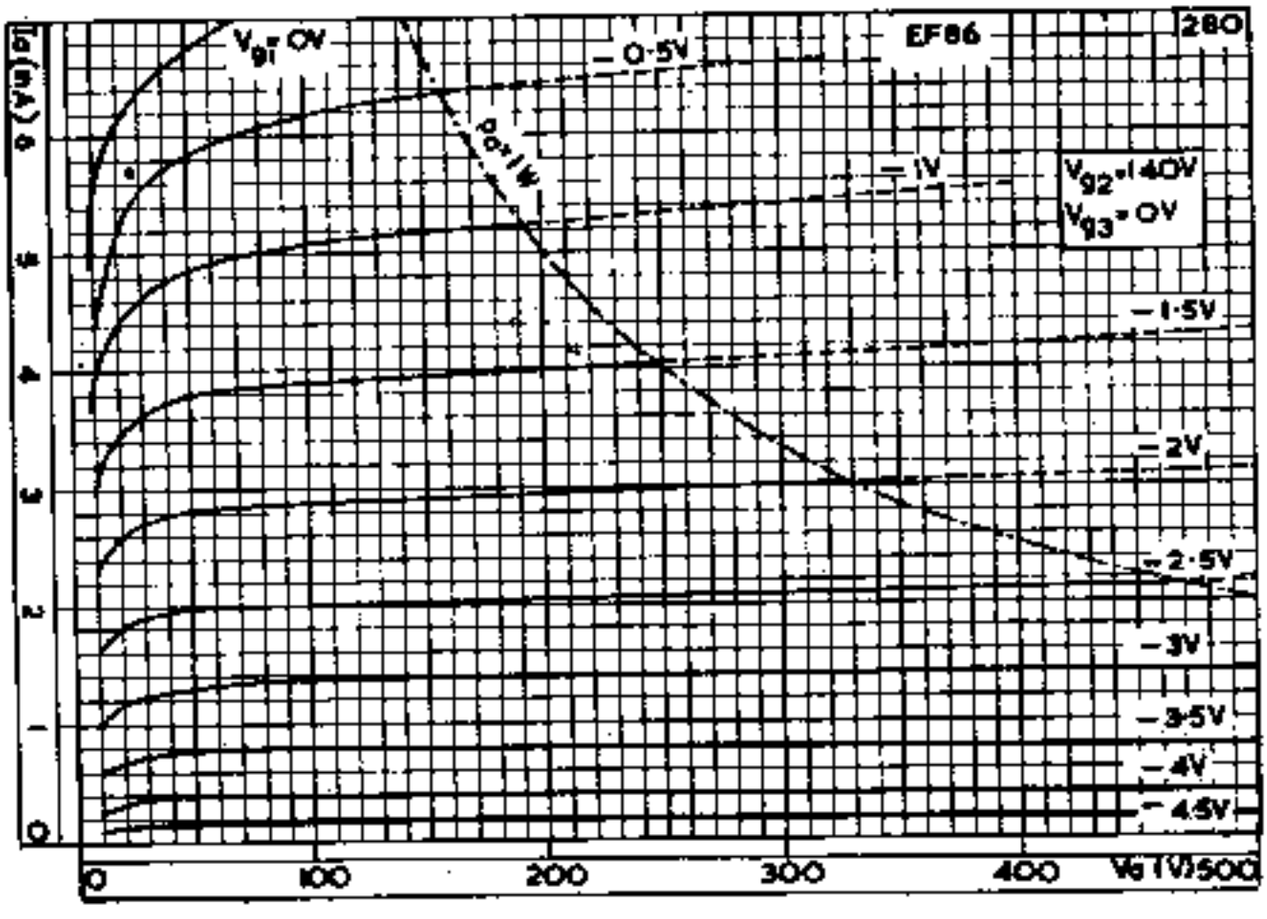


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

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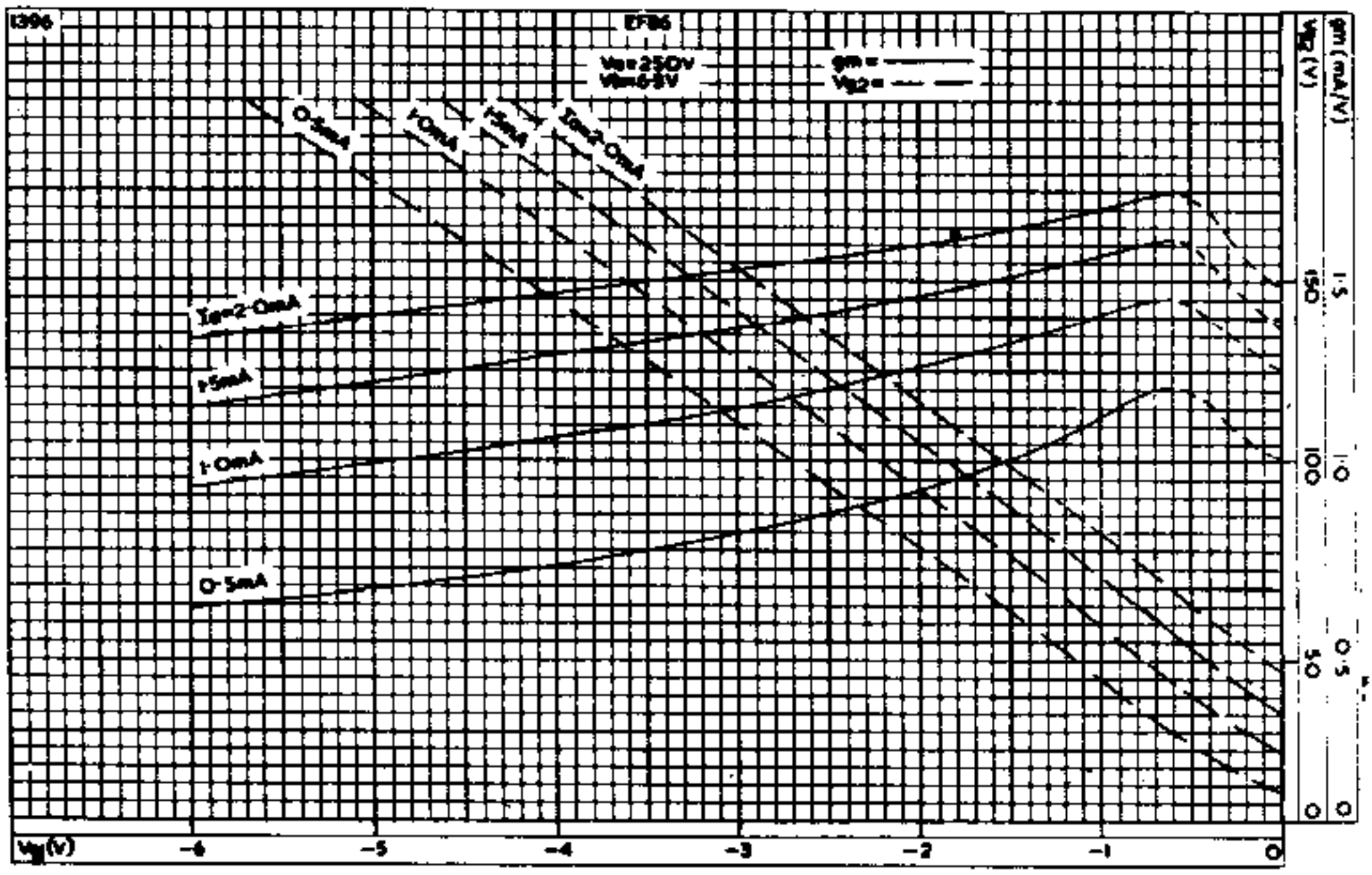
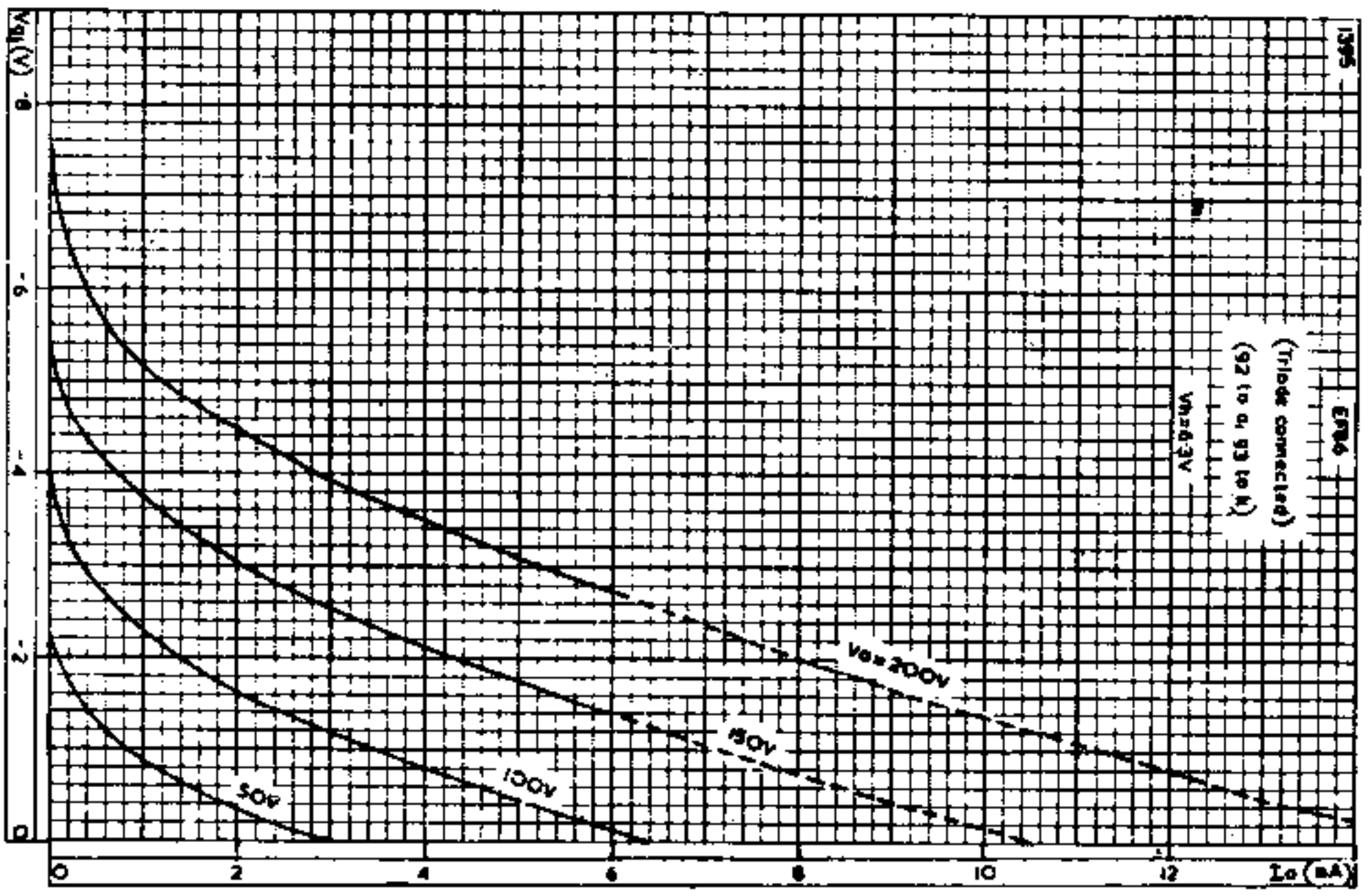


MUTUAL CONDUCTANCE AND SCREEN-GRID VOLTAGE PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE CURRENT AS PARAMETER.



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER, WHEN CONNECTED AS A TRIODE.

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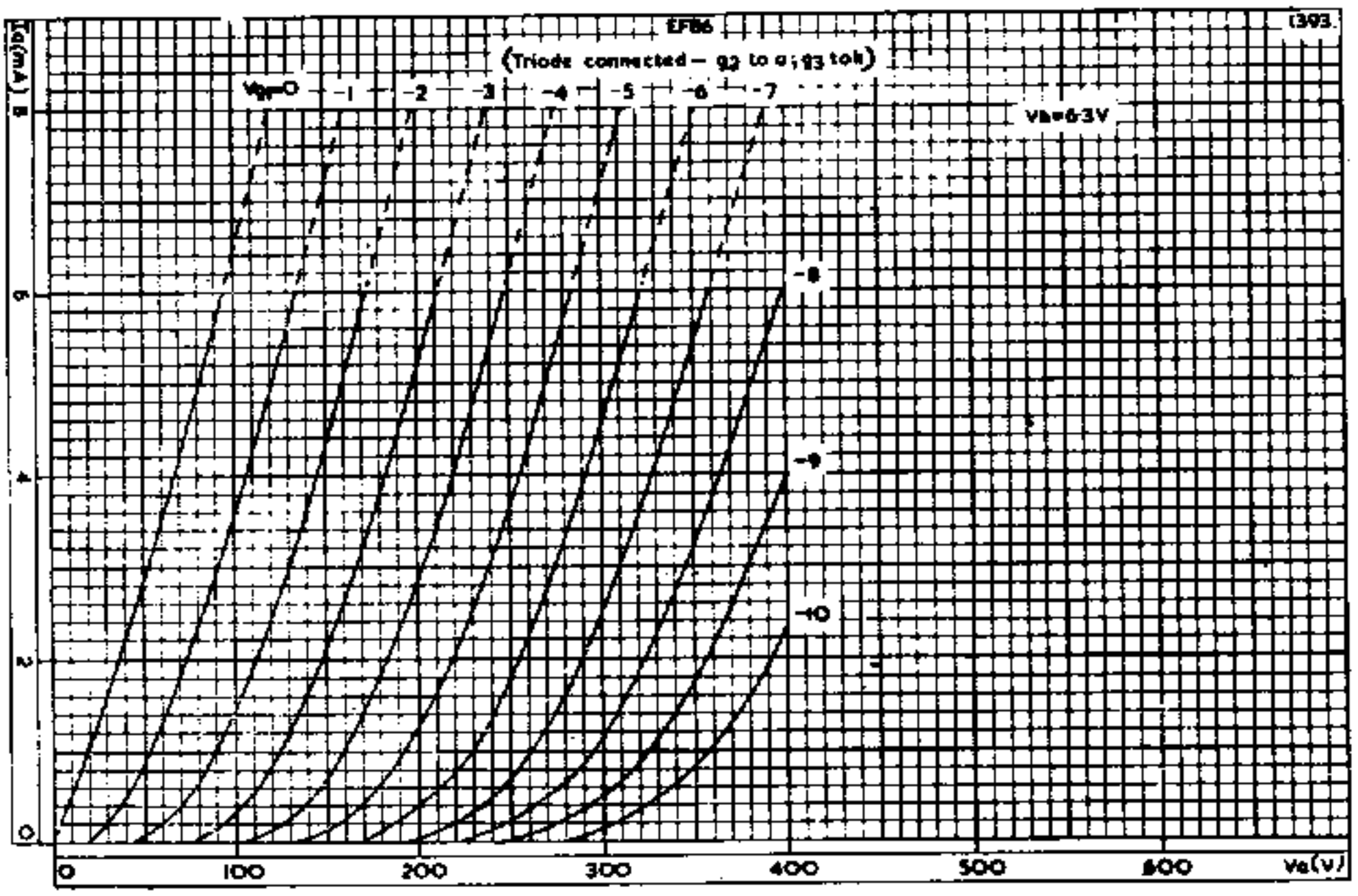
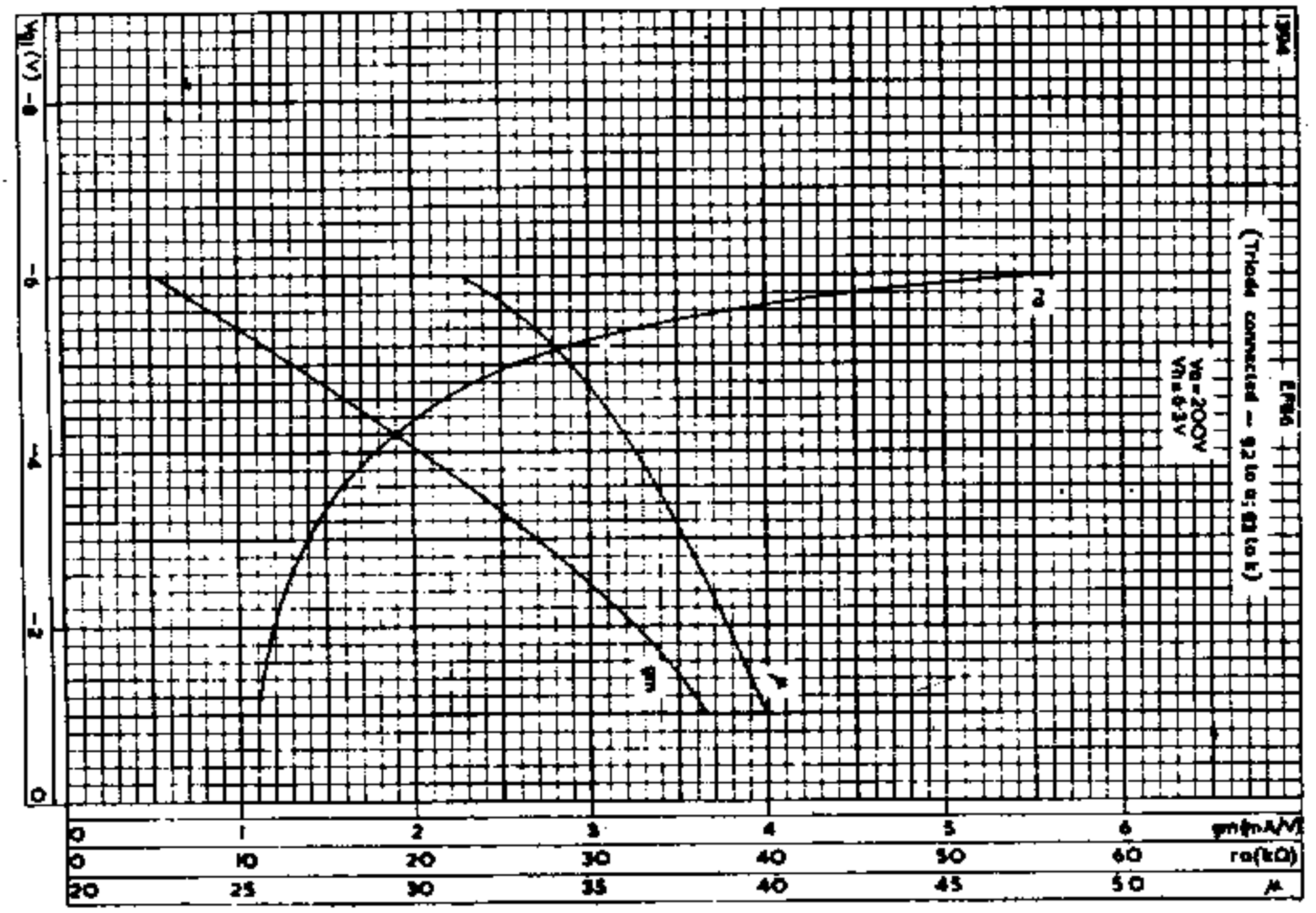


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER, WHEN CONNECTED AS A TRIODE.



MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST GRID VOLTAGE, WHEN CONNECTED AS A TRIODE.

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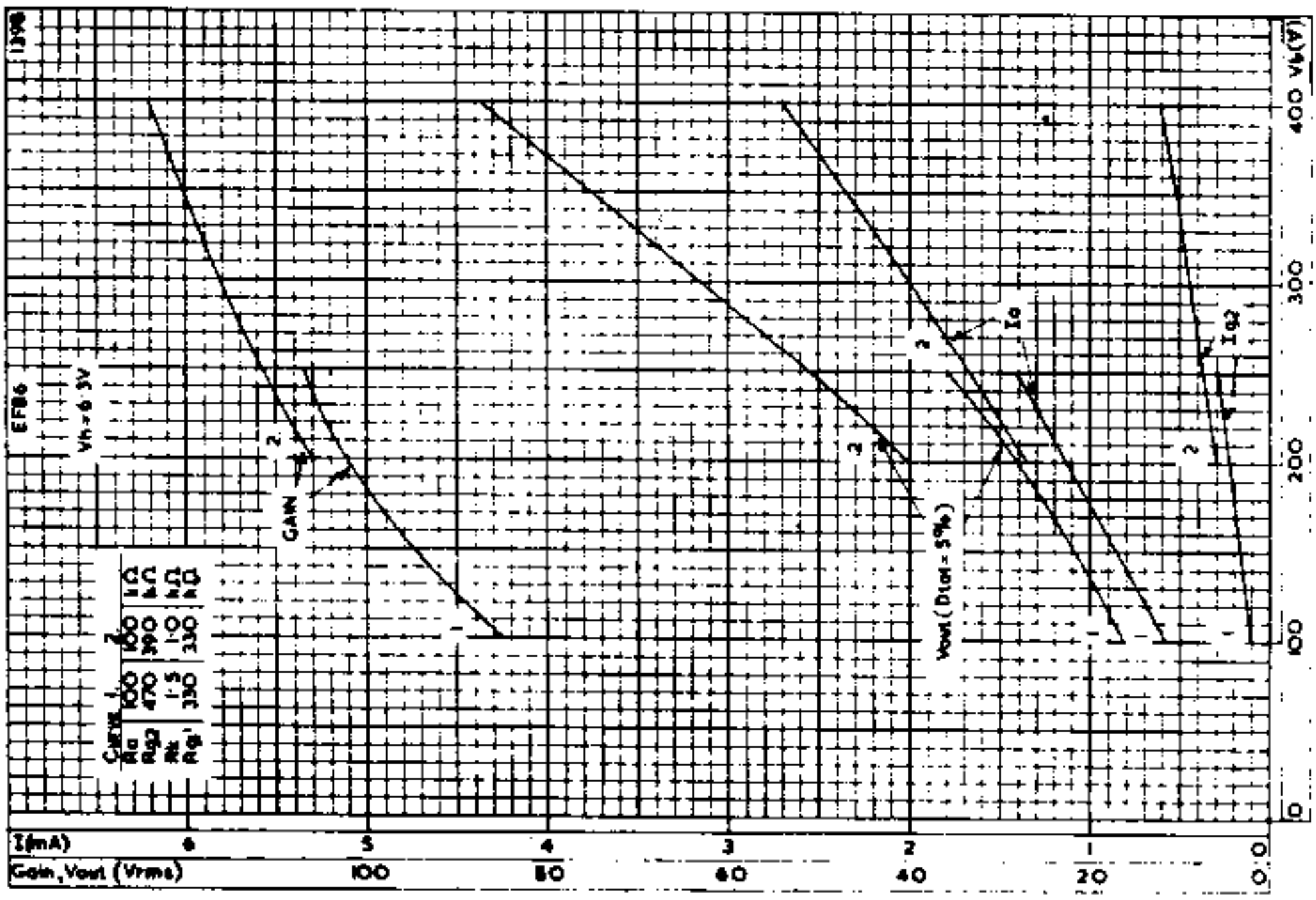
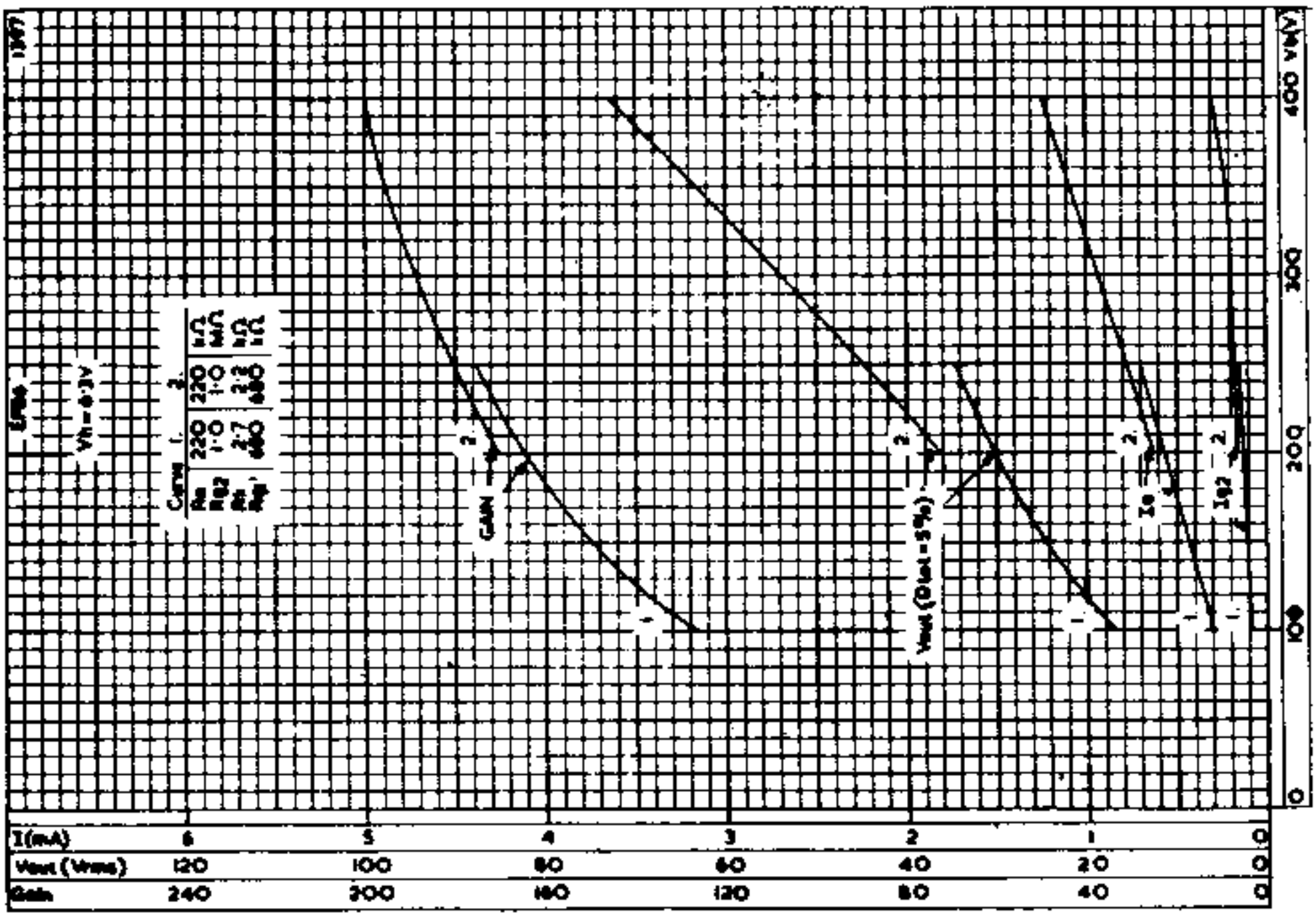


PERFORMANCE OF EF86 AS PENTODE CONNECTED R.C. COUPLED AMPLIFIER PLOTTED AGAINST LINE VOLTAGE, FOR R_a 100 k Ω.



PERFORMANCE OF EF86 AS PENTODE CONNECTED R.C. COUPLED AMPLIFIER PLOTTED AGAINST LINE VOLTAGE, FOR R_a 220 k Ω.